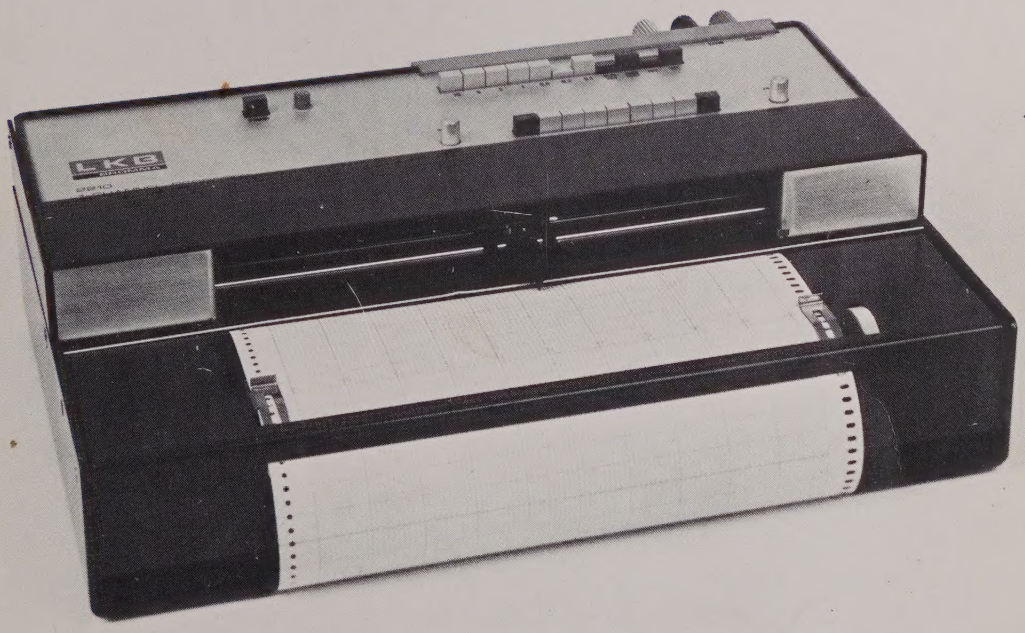
Instrument Manual

LKB

LKB 2210 Potentiometric Recorder



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PLEASE READ THIS MANUAL CAREFULLY BEFORE ATTEMPTING TO USE THE INSTRUMENT

Foreword

This manual describes the LKB 2210 Potentiometric Recorders. The first three sections deal with the physical description, installation and usage of the instrument and contain all the information needed to operate the recorders for chromatographic applications.

Appendix A lists the technical specification
Appendix B deals with the external connector
Appendix C describes the calibration of volume-axis
Appendix D contains the accessories

If you have any comments on this manual, we will be pleased to receive them at:

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Since product development and improvement is a continous process, LKB reserves the right to make changes in the specification without notice.

Warranty and Liability

LKB-Produkter AB guarantee that their delivered instrument has been thoroughly tested to ensure that it meets its published specification.

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INTRODUCTION

A laboratory recorder must be able to meet a variety of demands. It must cover a wide range of paper chart speed and input voltage ranges. It is expected to have a fast and accurate response with a fine pen trace to take advantage of the resolution and it has to yield satisfactory perfomance under varying temperature conditions.

The LKB 2210 Potentiometric Recorders not only provide these basic instrument functions but offer additional advantages for the modern chromatographer:

- built-in event marker
- volume-controlled chart speed
- compact design
- power cut-off function for servo-motor protection
- compatibility with outstanding LKB equipment

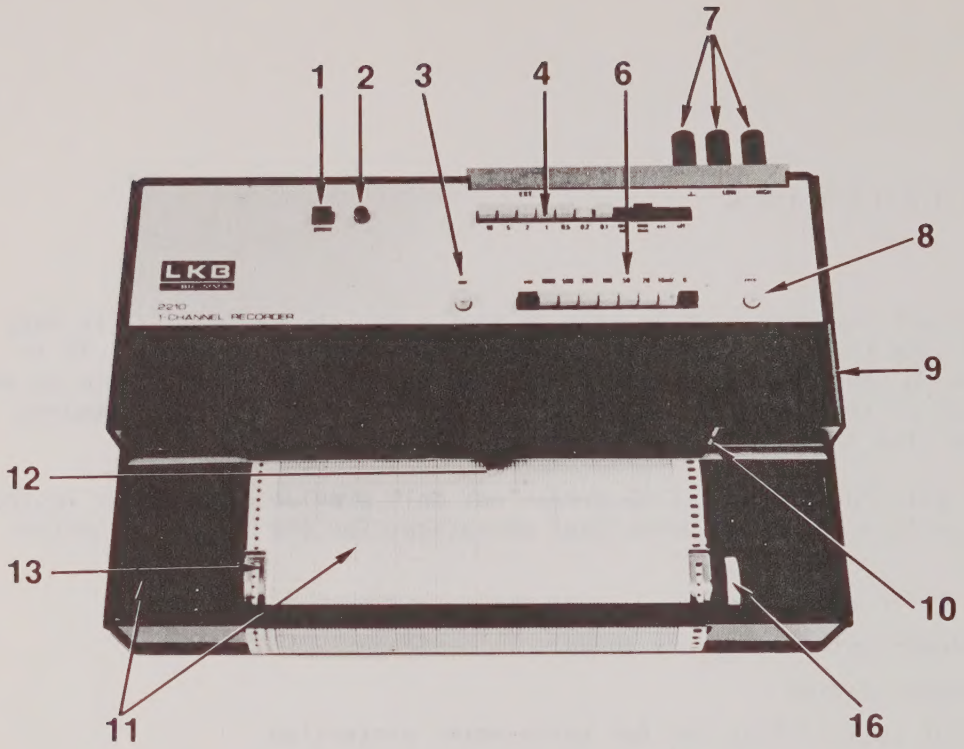

Fig. 1

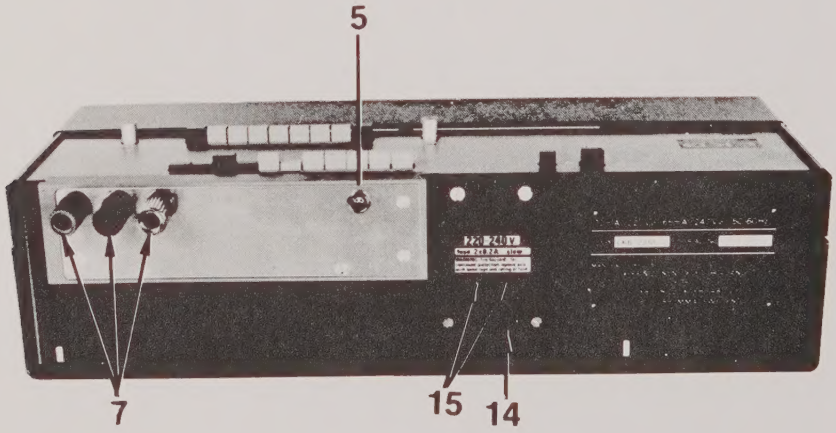

Fig. 2

PHYSICAL DESCRIPTION

Operating controls - see Fig.1 and 2

1. Power switch
2. Pilot lamp
3. Variable range setting
4. Chart speed selector
5. External connector for event marking,remote start/stop and external oscillator.
6. Measuring range selector
7. Input terminals
8. Zero setting
9. Covering lid
10. Pen lift lever
11. Chart cassette
12. Recorder pen
13. Chart guides
14. Mains connector
15. Fuses
16. Manual chart drive

I N S T A L L A T I O N

When unpacking the instrument, please check with the packing list to ensure that all items are included.

Before you plug in the recorder make sure that the voltage rating of the instrument matches the mains supply.

See to it that the correct fuses -as indicated below- are inserted into the fuse holders -15 in Fig.2

for 115 V - - - 2 × 0.5 A

for 220/240 V - - 2 × 0.2 A

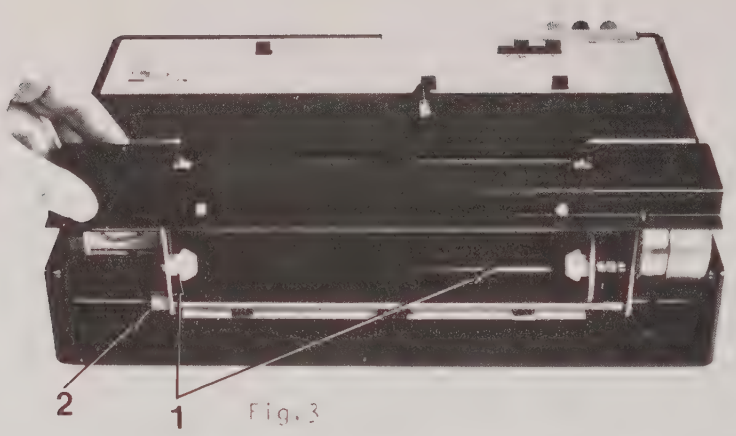

Fig.3

Fig.4

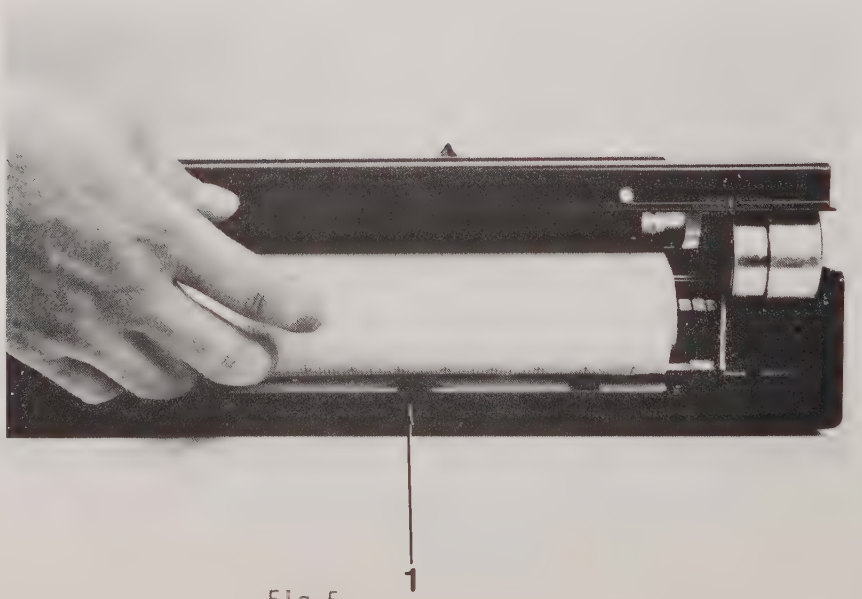

Fig.5

OPERATION

Inserting the chart roll

Fig. 3 Turn the paper cassette (11) into its upper snap-in position

Fig. 4 Two plastic guide cones (1 in Fig. 3) become visible. To load the cassette, the paper roll is pressed to the right against the spring-loaded cone until the chart roll can be pushed across the left cone.

N.B. The oval perforation must be positioned at the right hand side.

Fig. 5 Slide the end of the chart paper into the slit marked with an arrow (1) and push until the paper emerges at the writing area.

Fig. 6&7 Replace the paper cassette in the original position by releasing the lever (2 in Fig. 3). Raise the paper guides (13). Pull the chart by hand until the chart drive sprockets are engaged in the perforations of the chart paper.
Push down the paper guides and unroll the paper with the manual chart drive (16). Make sure that the paper is aligned to the side of the recorder.

Servosystem

The recorders operate on a null-balancing potentiometric principle. The amplitude of the input signal is continually compared with that of a calibrated voltage in the recorder. The amplified voltage difference between the input signal and the latter is used to activate a servo-motor which rotates until a null balance is achieved. The servo-motor is mechanically coupled to the recording pen and the actual position of the pen over the chart paper is therefore equivalent to and a measure of the amplitude of the input signal.

Automatic servo-motor cut-off

Should the pen travel be impeded or should the voltage exceed the selected range limits, the current supply to the servo-motor is cut off after a delay of 0.5 seconds. Hence, the servo-mechanism is never exposed to unnecessary wear.

When the pen travel is free or when the voltage reappears within range again, the operation of the servo-motor is immediately and automatically resumed.

Pens

The writing system is very simple and convenient with reliable fibre pens of the disposable cartridge type. The pens leave a very fine trace and will not "bleed".
After having removed the cap, the pen must be gently inserted into the pen-holder without any side pressure. When the recorder is not in use, remember to keep the tips of the fibre pens covered with the caps to prevent drying out of the ink. Pens are supplied in standard boxes, each comprising 6 pens.

There are two types of pens as shown in Fig. 8 - cat.no. 2210-210 with short nib, blue, for channel 1 and cat.no. 2210-220 with long nib, red, for channel 2 in two-channel recorders.

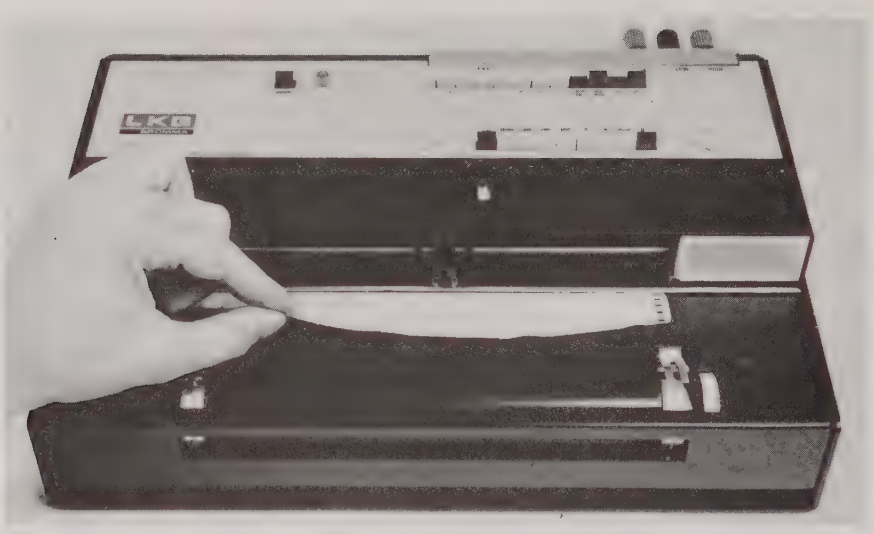

Fig.6

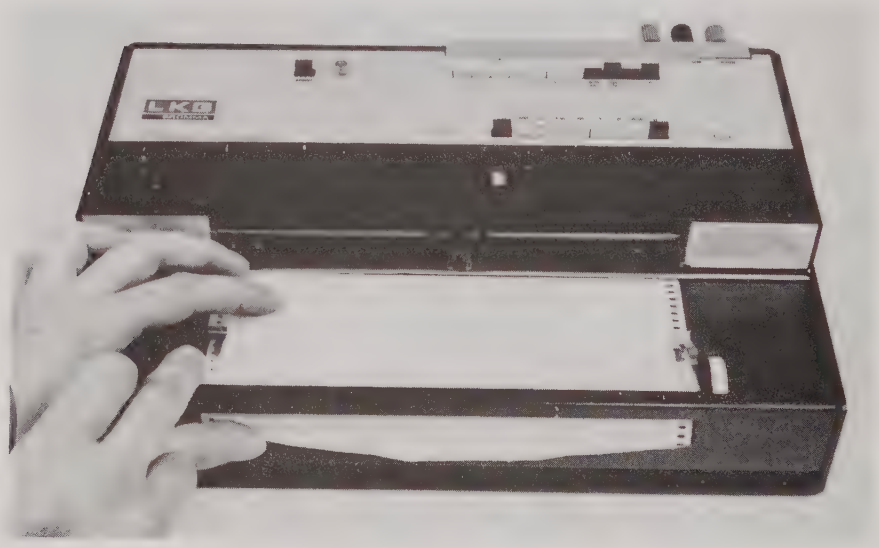

Fig.7

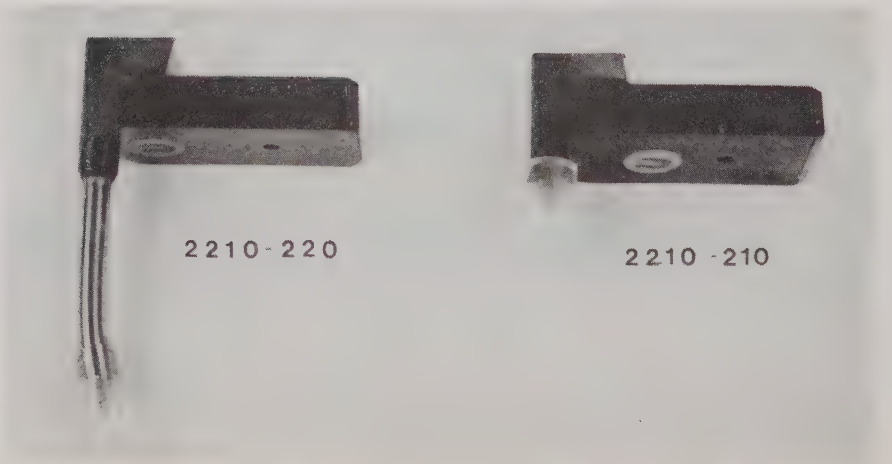

Fig.8

Event marking

Event marking is performed as a displacement of the pen by two scale divisions to the right. The event marking signal must be a closure to ground, such as the event marking signal from the LKB 2112 RediRac or the LKB 2070 UltroRac II fraction collector.
The signal must be connected to pin 4 of the EXT-socket on the rear panel of the recorder.
When using the aforementioned fraction collectors, LKB 2040-105 Connecting cable must be connected to the event marking socket on the fraction collector and to the EXT-socket of the recorder - see Fig. 9.

When used with the LKB 7000 UltroRac, the LKB 7000 UltroRac should be modified. Please call your local service engineer.

Paper chart drive

The paper chart drive is a stepper-motor which is operated either from the internal frequency generator or by an external TTL-level frequency.
When operated by the internal frequency, paper speeds can be selected with push buttons located on top of the instrument with the following speed ranges:

10	mm/s = 60 cm/min	10	mm/min = 60 cm/h
5	mm/s = 30 cm/min	5	mm/min = 30 cm/h
2	mm/s = 12 cm/min	2	mm/min = 12 cm/h
1	mm/s = 6 cm/min	1	mm/min = 6 cm/h
0.5	mm/s = 3 cm/min	0.5	mm/min = 3 cm/h
0.2	mm/s = 1.2 cm/min	0.2	mm/min = 1.2 cm/h
0.1	mm/s = 0.6 cm/min	0.1	mm/min = 0.6 cm/h

Also the chart drive is automatically stopped after a run when the LKB 2120 Varioperpex pump is stopped by the fraction collector.

N.B. When operated from an external frequency source, which must be connected to pin 3 of the EXT socket, the "EXT" button of the chart speed selector must be depressed. The chart speed will then amount to

$$\frac{f}{200} \times \text{the chosen chart speed}$$

f being the frequency of the external frequency source.

Volume-axis

The LKB 2120 Varioperpex pump can be used as the external frequency source for the recorder. This being the case, the LKB 2120 Varioperpex pump must be connected to the LKB 2112 RediRac or the LKB 2070 UltroRac II with the 2040-105 cable connected to the pump socket on the fraction collector. As shown in Fig. 9 the event marking socket of the fraction collector is connected to the recorder with yet another 2040-105 cable.
With this setting-up, the frequency of the pump stepper motor, which is directly proportional to the volume of liquid pumped through the pump (regardless of changes in flow rate, viscosity etc.) will control the paper chart drive of the recorder. Hence, the X-axis of the recorder will represent a volume-axis.

It is therefore possible to compare chromatograms which were run at different flow rates and to obtain direct measures of void volumes, peak volumes and retention volumes.

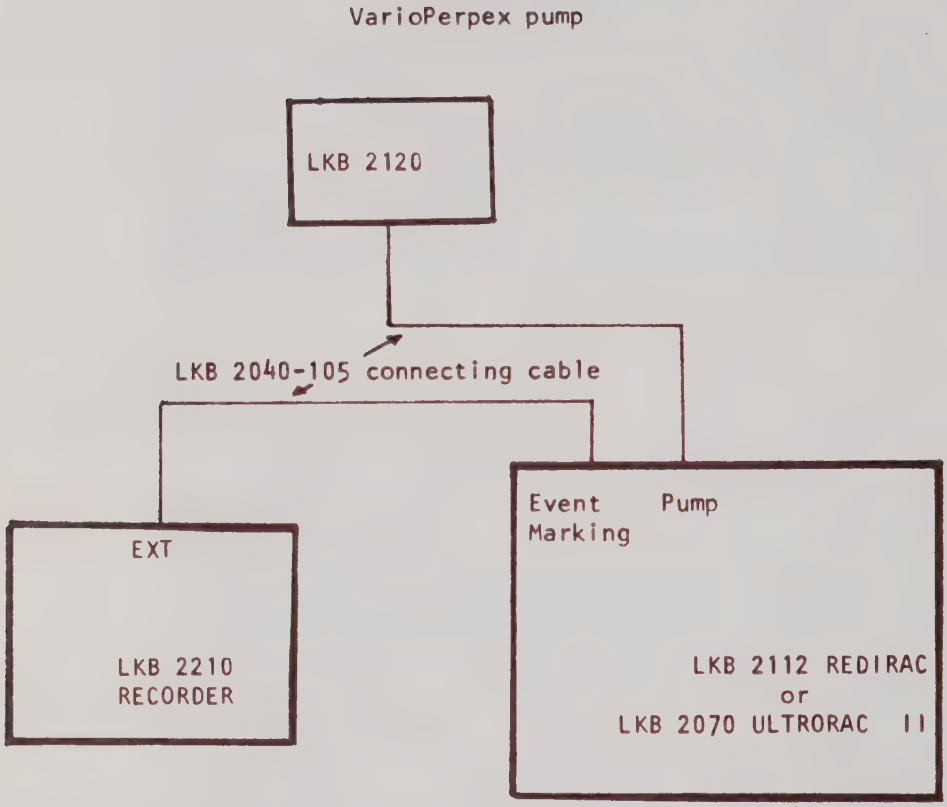
VarioPerpex pump
LKB 2120
LKB 2040-105 connecting cable
EXT
LKB 2210
RECORDER
Event Pump
Marking
LKB 2112 REDIRAC
or
LKB 2070 ULTRORAC II

Fig.9

Remote ON/OFF control of chart drive

This facility makes it possible to start or to stop the paper chart drive from an external instrument.This can be done in two ways:

I. With the 'OFF'-button of the chart drive released,the paper drive is activated by a TTL-high or no connection on pin 2 in the EXT-socket and deactivated by a TTL-low or common on the same pin.

II. With the 'OFF'-button on the chart drive depressed, the paper drive is activated by a TTL-low or common on pin 2 in the EXT-socket and deacti vated by a TTL-high or no connection on this pin.

Input signal

The input signal is connected to the banana plugs on the rear panel. The terminal marked 'Low' must be connected to the side of the signal source which has the lowest impedance to ground (the other side of the source to 'High'). The terminal marked with the earth symbol can be used to ground the signal source ('Low') if it is not grounded elsewhere.

Zero check

A true electrical zero input to the amplifier can be obtained as indicated by the 0 mV position of the input range selector.

Zero adjustment

The zero is continously adjustable between -50% of f s d to 150% of f s d by turning the zero knob accordingly.

Calibrated input ranges

The recorder comes with 7 calibrated input ranges:

10,20,50,100,200,500,1000 mV

Each range is selected by depressing the appropriate push button on the input range selector -see 6 in Fig. 1

Variable input ranges

For as long as the push button marked 'VAR' remains depressed,the 'VAR' knob can be used to adjust the full scale deflection between 40-100% of the selected input range.
Example:
Assume that you have a signal varying between 0 and 25 mV and that you wish to avail yourself of the entire width of the scale.
Push the 50 mV button down so that the amplitude (25 mV) reaches 50% of the scale.Then press the 'VAR' button and adjust the deflection to 100% by means of the aforementioned knob marked 'VAR'.

Recording

When all connections are made and the chart roll is inserted,the recorder is ready for use.

Prior to switching on the mains, the 'OFF'-button -4 in Fig.1- should be in the Off position and the zero should be pushed on the measuring range selector -6 in Fig.1.Also see "Remote ON/OFF control" on previous page.

Switch on the mains and adjust the zero position of the pen by means of the zero knob 8 in Fig.1

Select the required measuring range and release the zero button.

If the amplitude of the signal is unknown,it is advisable to start with. less sensitive ranges and then increase the range until a suitable pen deflection occurs.

The pen is lowered onto the chart paper with the lever 10 in Fig.1

Select a suitable chart speed and release the 'OFF'-button of the chart speed selector.

APPENDIX A

Technical Specification

Accuracy	better than 0.3% of fsd (200 mm)
Dead band	within 0.2% of fsd
Linearity	better than 0.3% of fsd
Response	0-95% of fsd within 0.4 s
Pen speed	max. 450 mm/ s
Input impedance	1 Mohm
Zero adjustment	from -50% to +150% fsd
Zero drift	2 uV/^{o}C
Input current	5 nA
Input	floating, asymmetrical
Common mode rejection	130 dB DC
Chart width	200 mm
Pen lift	manual
Pens	disposable fibre tip pens
Chart drive	0.1/0.2/0.5/1/2/5/10 mm/s and mm/min
Chart length	25 metres
Chart life	4100 h at 0.1 mm/min ; 41 min at 10 mm/s
Input ranges	10/20/50/100/200/500/1000 mV
Mains supply	115/220 V -15%,+20%, 50/60 Hz
Power consumption	15 W
Dimensions	366 x 236 x 108 mm
Weight	6.5 kg
Temperature range	0^{o}C to +40^{o}C

APPENDIX B

External Connector

Pin 1: Ground

Pin 2: $\overline{\text{Stop}}$ - see "Remote ON/OFF control of chart drive".

Pin 3: $\overline{\text{External}}$ frequency - the pulse frequency must be TTL-level.

Pin 4: $\overline{\text{Event marking}}$ - the event marking is activated when pin 4 is grounded.

APPENDIX C

Calibration of Volume-axis

The signal frequency from the LKB 2120 Varioperpex peristaltic pump is proportional to the volume of liquid displaced by the pump.
The volume delivered per pulse is dependent upon:

a/ the size of tubing used
b/ the condition of the tubing
c/ the pressure applied on the tubing

It is therefore necessary to calibrate the pump to determine the volume delivered in relation to the chart speed. Proceed as follows:

1) Set up the pump, recorder and fraction collector as indicated in Fig. 9

2) Immerse one end of the tubing in a beaker filled with water

3) Connect the other end of the tubing to the tip of a 1 ml graduated pipette.

4) Set the buttons of the chart speed selector to 10 mm/s, 'EXT' and 'OFF' position and make a mark on the chart paper.

5) Start the pump and watch the water rising in the tubing

6) When the water level has reached the tip of the measuring pipette, start the recorder chart drive by releasing the 'OFF' push button

7) Bring the chart drive to a halt as soon as the water level hits the 1 ml graduation mark

8) Measure the chart length in cm and calculate the volume/cm as represented by the chart speed:

$$\frac{1}{\text{measured chart length}} \left[\frac{\text{ml}}{\text{cm}}\right]$$

9) The calculated value is valid for the '10 mm/s' button of the chart selector. Other chart speeds can be obtained by means of the other push buttons. Accordingly, e.g. 0.1 mm/s will now correspond to:

$$\frac{0.1}{10} \quad \frac{\text{mm/s}}{\text{mm/s}} = 0.01$$ times the volume/cm chart speed previously calculated.

APPENDIX D

Accessories

LKB 2210-110	Chart paper, pack of 10 rolls, each graduated from left to right 0-100%, length 25 m.
LKB 2210-210	Fibre tip pens of disposable cartridge type, pack of 6 short nib blue pens for single-channel recorder and for channel 1 of a two-channel recorder - see Fig. 8.
LKB 2210-220	Fibre tip pens of disposable cartridge type, pack of 6 long nib red pens for channel 2 of a two-channel recorder - see Fig. 8.
LKB 2040-105	Connecting cable for use as shown in Fig. 9.

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